Exhibit B

Accident Reconstruction Report

Lately Vs. Silacal, Inc.

Authored by: Andrew Rich
Rich Consulting, LLC

Prepared for Florence Murray, Esq.
Murray & Murray Co.

Date of Accident: June 27, 2020

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Accident Identifiers

Date: June 27, 2020.

Time: 11:41 p.m.

Location: Interstate 80 eastbound, 0.4 miles west of mile post 82, Harris Township, OH

Persons and Vehicles Involved

1. Michael L. Lately, male, 64 years of age, of 616 Neil Street, Sandusky, OH. Mr. Lately had been operating a 2014 Chrysler 300, four-door, color gray, bearing Ohio registration HIY1197. Mr. Lately suffered serious injuries, including a traumatic brain injury (TBI) because of the crash.
2. Patrick Ferrell, male, 51 years of age, of 1174 Nugent Avenue, Bay Shore, N.Y. Mr. Ferrell had been operating a 2015 Volvo VNL 670 series 6 X 4 tractor. The tractor was attached to a 2008 Stoughton semitrailer. In a written statement provided at the scene of the crash, Mr. Ferrell stated that he was not injured.

General Facts

On June 27, 2020 just prior to 11:41 p.m., Patrick Ferrell parked his tractor-trailer on the eastbound shoulder of Interstate 80 in the Township of Harris, Ohio. The area in which he stopped was a construction zone. According to a statement that he gave on June 28, 2020 at the Ohio State Highway Patrol (OSHP) post, he stopped because, “I had to pee.” Upon reentering the travel lanes, he pulled directly into the left lane where Michael Lately struck the left rear of the semitrailer with the right front of his Chrysler 300. It should be noted that Mr. Ferrell had passed a rest area on the Ohio Turnpike approximately 4.5 miles west of the crash site.

According to the crash report, it had been raining at the time of the crash and the roadway was wet.

Scope of Service

On January 20, 2021, Attorney Florence Murray retained Rich Consulting, LLC to determine what difference there would have been in the results of the crash if the truck had been traveling at the 50-mph speed limit. Rich Consulting charges $250 per hour for all reconstruction services, $150 per hour for an associate reconstructionist/technician when needed, and $75 per hour for administrative work.

Executive Summary

All opinions in this report are expressed within a reasonable degree of scientific certainty. The severity of a crash, which includes damage to vehicles and occupant injury potential, is a function of a vehicle's change-in-velocity, or delta-V (Wang, 2022). I analyzed the Chrysler's event data recorder (EDR) data and the delta-V was reported to be between -57 and -70 mph. If the truck had been traveling at the 50-mph speed limit, the Chrysler's delta-V would have been reduced to -31 to -36 mph. The probability of serious injury at a delta-V range of -57 to -65 mph is 92% to 98%. The probability of serious injury at a delta-v range between -31 and -36 mph is 14% to 24% (ibid). Therefore, it is more likely than not that Mr. Lately would not have received the serious injuries that he suffered on June 27, 2020 if the truck had been traveling at the speed limit.

Document Review

I reviewed the following documents during the reconstruction of this crash:

1. 2015 Diesel Truck Index, pages 262 and 263.
2. Ohio Department of Transportation Traffic Crash Report (12 pages).
3. VIN Decoder report for the 2015 Volvo truck (9 pages).
4. Canadian Vehicle Specifications for the 2014 Chrysler 300 (2 pages).
5. Vin Decoder report for the 2014 Chrysler 300 (9 pages).
6. Bosch CDR report (Ver. 21.0, Ver. 23.3 and Ver. 23.4.1) for the 2014 Chrysler 300 (37 pages).
7. Google Earth images of the crash site.

8. Forty-eight color photographs taken at the scene by the OSHP. The photos are sequentially numbered from DSCN9818.JPG to DSCN9865.JPG.
9. Six color photographs taken during a vehicle inspection by STARS Consulting, LLC. The photographs I reviewed were DSC_0008.jpg, DSC_0020.jpg, DSC_0023.jpg, DSC_0024.jpg, DSC_0028.jpg and DSC_0032.jpg.
10. Hrycay Engineering Consultants Data Imaging Report for the Volvo tractor.
11. United States Cold Storage, Inc. Straight Bill of Lading—Short Form (2 pages).
12. Deposition of Michael Lately (91 pages).
13. Deposition 30(B)(6) of Krzysztof Karleszko (100 pages).
14. Deposition (Individual) of Krysztof Karleszko (71 pages).
15. Construction plan addendum-1—Project No. 59-20-01(9 pages).

Site Inspection

I visited the crash site on October 10, 2023. Present with me was Dennis Seal, Ph.D. I made a video recording of our approach to the crash site with a GoPro Hero 11 video camera. The recording started just west of the Wyandot Service Plaza and ended when we arrived at the crash site. I imported the video into Telemetry Overlay software and embedded my vehicle GPS speed, heading, distance from the start of the video, date, time and map position into the video. The video was sent to Dr. Seal to assist with his analysis. During the site inspection I took 27 digital photographs. N.B. that the roadway layout had changed since June 27, 2020, which was evident from the change in the left shoulder width (Photograph 1 and Photograph 2 on Page 8).

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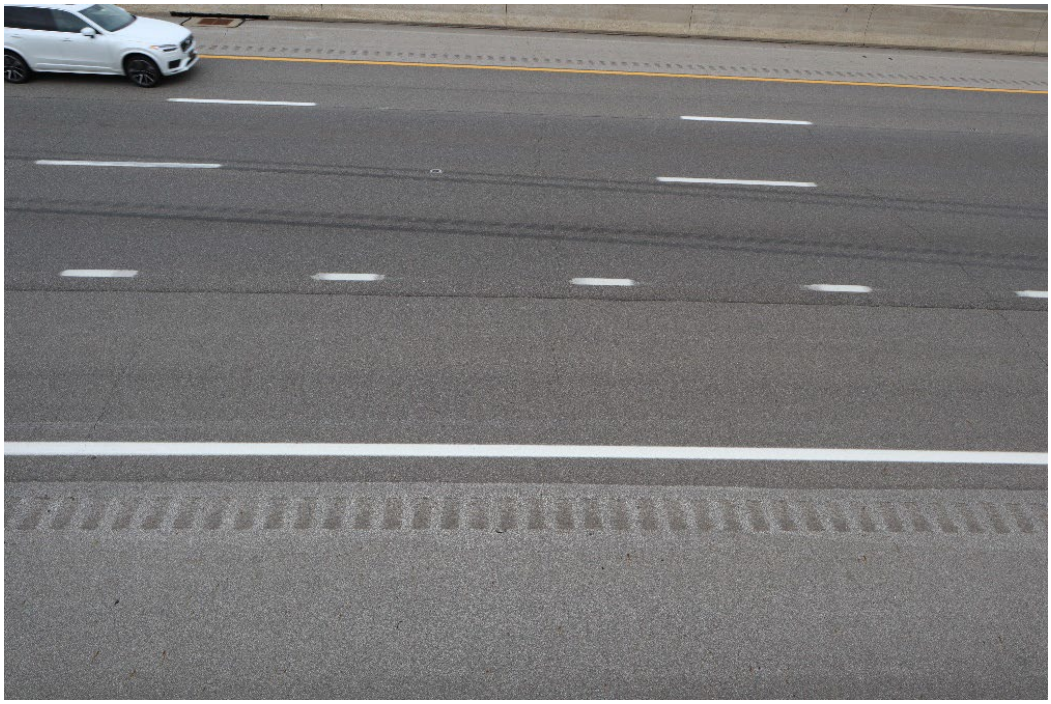
Photograph 1: Left shoulder on June 27, 2020.



Photograph 2: Left shoulder on October 10, 2023.

Depositions

Nothing contained in the depositions of Michael Lately, Krzysztof Karlesko [30(B)(6)] or Krzysztof Karlesko (individual) were pertinent to my analysis.

Reconstruction

Definitions

Delta-V: Abbreviation for the change-in-velocity. The word velocity implies that delta-V is a vector. A vector has both magnitude and direction. The magnitude portion of velocity is known as speed. In this crash, most of the delta-V occurred along the Chrysler's longitudinal (rear to front) axis. Therefore, the delta-V calculations are simplified. Delta-V example: a car strikes an immovable barrier at 30 mph and stops without rebounding from the barrier. The delta-V is -30 mph (0 – 30 = -30). The probability of injury is a function of delta-V magnitude. The greater the delta-V magnitude, the greater the probability of injury (Federal Highway Administration, 1998), (Monson & Germane, 1999), (Wang, 2022) and (Baker, Martin, Wilson, Ghajari, & Sharp, 2021).

Closing Speed: Closing speed is the magnitude of closing velocity. Because both vehicles were traveling in approximately the same direction at impact, direction does not have to be considered and the analysis may be limited to closing speed. Closing speed in that regard is the relative speed between two vehicles prior to impact, or the difference between the speeds of two vehicles prior to impact. Closing speed example: Vehicle A strikes Vehicle B in the rear. Vehicle A was traveling 50 mph and Vehicle B was traveling 30 mph. The closing speed is 20 mph. Closing speed determines how high the delta-Vs for the two vehicles will be. Therefore, the probability of injury is also a function of closing speed. The higher the closing speed, the higher the delta-Vs and therefore, the higher the probability of injury.

Coefficient of Restitution: The coefficient of restitution is a unitless number that indicates how much energy is returned to a system during a crash. Restitution can be considered a force that wants to push a damaged vehicle back into its original shape, just as when one

pushes on a spring, the spring will deform. When one releases the spring, the spring returns to its original shape. For example: In a car-to-barrier crash test contracted by the National Highway Traffic Safety Administration (NHTSA), a car is pulled into a barrier at approximately 30 mph. The car will rebound from the wall at approximately 3 mph. The coefficient of restitution is 3/30 or 0.1. In the example that I gave for the definition of delta-V, the car that struck the barrier did not rebound from the barrier. The car's post-impact speed was 0 mph. Therefore, the restitution was 0/30 or 0. In the NHTSA crash test the delta-V is -3 - 30 = -33 mph. The takeaway here is that an increase in restitution causes an increase in delta-V. When calculating closing speed from delta-V, one must make an adjustment for the coefficient of restitution or the closing speed will be overestimated.

Hrycay Engineering Consultants Data Imaging Report

Hrycay Engineering Consultants downloaded the Volvo tractor's engine control module (ECM) on July 24, 2020. Note that the ECM's date was off. According to the ECM, the date of the download was November 18, 2020 (four months in the future). There were two events stored inside the ECM; a last stop event and an acceleration-triggered event. Both events were created on July 24, 2020 (November 18, 2020 ECM date). The acceleration-triggered event created on July 24, 2020 overwrote any acceleration-triggered events that occurred previously.

EDR Report

Steven Belysus of STARS Consulting, LLC downloaded the Chrysler 300's EDR on July 27, 2020 with Version 19.4.2 of the CDR software. I obtained a copy of the raw data (the CDRx file) and interpreted the data with the latest version of the CDR software, which on October 31, 2023 was Version 23.3. On February 17, 2024, I reinterpreted the data with Version 23.4.1. Figure 1 on Page 11 shows that there were two events recorded in Chrysler's EDR. I determined that both events were related to the crash on June 27, 2020.

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CDR File Information

User Entered VIN	2C3CCABG1EH356999
User	S.Belyus
Case Number	KyleWright-Lately
EDR Data Imaging Date	07/27/2020
Crash Date	06/27/2020
Filename	2C3CCABG1EH356999_ACM.CDRX
Saved on	Monday, July 27 2020 at 12:01:10
Imaged with CDR version	Crash Data Retrieval Tool 19.4.2
Imaged with Software Licensed to (Company Name)	STARS Consulting, LLC
Reported with CDR version	Crash Data Retrieval Tool 21.0
Reported with Software Licensed to (Company Name)	Rich Consulting LLC
EDR Device Type	Airbag Control Module
Event(s) recovered	Most Recent Event, Deployment 1st Prior Event, Deployment

Figure 1: Recovered events.

The Chrysler's Impact Speed

The precrash speeds reported by the EDR are an average of the wheel speeds of the drive wheels. Those wheel speeds may be affected by changes to the factory-installed final drive ratio or tire size, in addition to wheel lockup, wheel slip, or wheel spin (Figure 2 below).

- Speed, Vehicle Indicated - This indicates the average of the wheel speeds of the drive wheels.
  - On the 2008 - 2009 Dodge Grand Caravan, 2008-2009 Chrysler Town and Country and 2009 Dodge Journey, the reporting resolution is 2 km/h. On all other vehicles, the reporting resolution is 1 km/h.
  - To display this data element in mph, the CDR Tool converts the km/h to mph and reports a rounded value in mph.
  - The accuracy of the recorded Speed, Vehicle Indicated may be affected by a significant change of the tire size for the drive wheels or the final drive axle ratio of the transmission from the factory build specifications, wheel lockup, wheel slip, or wheel spin.
  - On some vehicles capable of speeds in excess of 255km/h (about 158mph), the actual vehicle speed may have exceeded the reporting range. It is always prudent to check the reported wheel speeds and other parameters to confirm the Speed, Vehicle Indicated value(s).

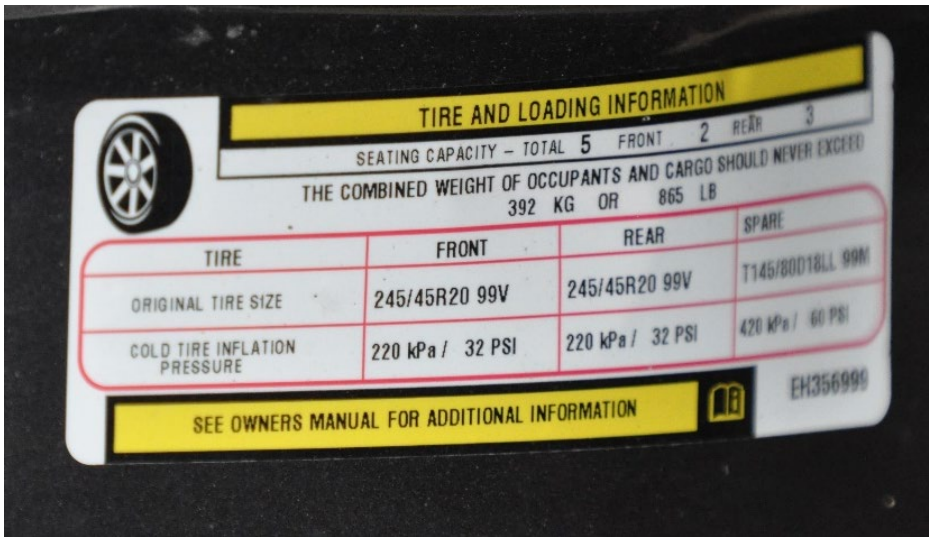
Figure 2: Data limitations from the CDR Report regarding precrash speeds.

Therefore, the speeds reported in the EDR must be properly vetted and adjusted where necessary.

In addition to the vehicle operating conditions and equipment modifications that may affect EDR-reported precrash speed, speedometer accuracy also affects the reported precrash speed. The first paper to address the accuracy of EDR precrash speeds was published by NHTSA in 1999 (Chidester, Hinch, Mercer, & Schultz, 1999). The NHTSA paper addressed the accuracy of late 1990's GM vehicles and reported a speedometer accuracy of +/- 4%. Testing on some Chrysler EDRs show better than 4% accuracy. Tests performed on a 2008 Dodge Caravan revealed an average error of 3% (Bortolin, Gilbert, Gervais, & Hrycay, 2010). 49 CFR Part 563 (federal requirements for event data recorders) require that EDRs installed in passenger vehicles after September 1, 2012 record speed within 1 kph (0.62

mph). There exists other research specific to Chrysler that indicates accuracy better than 4%. The data in the SAE "Compendium" paper indicates that 95% of the time, EDR-reported speeds are up to 1.5 mph below the true speed of the vehicle and 5% of the time EDR-reported speeds are up to 0.5 mph above the true speed of the vehicle (Bortles, Biever, Carter, & Smith, 2016). I used +/- 4% in my calculations, which accounts for the greatest amount of error reported in the research.

Chrysler measures vehicle speed from the wheel speed sensors (see the first highlighted line in Figure 2 on Page 11). That means changes to the axle ratio would not affect the EDR-reported speeds. The manufacturer recommended tire size for Mr. Lately's Chrysler 300 is 245/45R20 (Photograph 3).



Photograph 3: Manufacturer's tire and loading information decal. STARS photo DSC_0008.

The subject vehicle has a rear-wheel-drive powertrain. The tires that were on the rear axle of the Chrysler, as documented by STARS, were 245/50R20 (Photograph 4 on Page 13).

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Photograph 4: Rear tire photographed by STARS (Screenshot 2021-01-28 at 11.45.15 AM.png).

The diameter of the 245/50R20 tire is 3% larger than the factory recommended 245/45R20 tire. Tires of a larger diameter rotate slower than a smaller diameter tire, which cause the speedometer to read low—in this case 3% low.[1]

Another vehicle operating condition that affects the EDR-reported speed in this case is wheel slip due to ABS brake application. The EDR report indicates that ABS was active beginning at the -1.1 data point (First Prior Event). Wheel slip causes the EDR speed to report less than the actual vehicle speed (Ruth & Brown, 2009 Crown Victoria PCM EDR Accuracy in Steady State and ABS Braking Conditions, 2010). To determine an appropriate deceleration rate for the Chrysler, I plotted the EDR-reported speed data in an Excel chart (Figure 3 on Page 14). Note that the speeds in the chart are reported in kph. I analyzed in kph because this module stores speed in kph. When the speeds are converted to mph, the values are rounded. Working in kph avoids rounding errors.

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[1] i.e., if the speedometer reads 100 (actually 99.91, which is 3% of 103-but will be rounded to 100) mph, the true speed of the car is 103 mph.

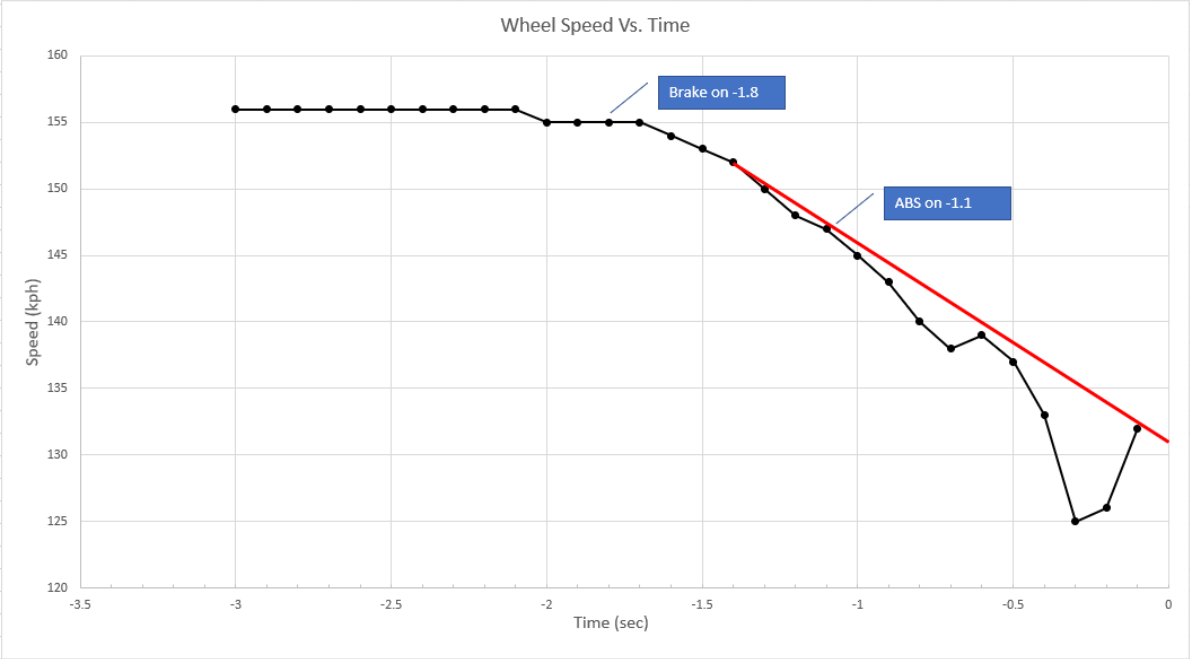

Figure 3: EDR-reported Speed Data. The speeds are reported in kph. This graph appears slightly different from the graph in the CDR report because the speeds in this chart are in kph. The speeds in the CDR graph are in mph. The red line is my estimate of the true speed of the car.

Mr. Lately activated the service brakes between the -1.9 and the -1.8 data point. In the first 0.1 second, the braking was not sufficient to slow the vehicle. It is not until after the -1.8 data point where a reduction in speed of 1 kph may be observed. Wheel slip may first be observed between the -1.3 and the -1.1 data point. Wheel slip is manifest due to the increase in the slope, immediately followed by a decrease in the slope between the -1.3 and the -1.1 data point as well as the onset of ABS activity at -1.1.[2] Between the -0.5 and the -0.4 data point there is a wheel speed reduction of 4 kph, which relates to a deceleration factor of -1.13 G. It is not possible for a vehicle to slow at -1.13 G on a wet surface. Between the -0.4 and the -0.3 data point the reduction in wheel speed was reported to be 8 kph, which relates to a deceleration factor of -2.26 G. It is not possible for a vehicle to slow at that rate even on a dry surface. Between the -0.2 and the -0.1 data point there was a reported gain in wheel speed of 6 kph. That relates to an acceleration factor of 1.7 G. It is not possible for the Chrysler to accelerate at 1.7 G even on a dry surface. The above speed anomalies are consistent with wheel slip due to ABS brake modulation. Any reported wheel speed that is affected by ABS will be lower than the true speed of the car.

[2] ABS activity is indicated in the pre-crash data on Page 23 of the CDR report.

To estimate the speed at impact for the Chrysler, I began at the -1.4 data point when the speed of the car was 152 kph (94 mph). At this data point the Chrysler had been slowing at an average rate of 0.28 G and there is no evidence of wheel slip due to ABS modulation. The red line in Figure 3 on Page 14 represents my estimate of the true speed of the car during braking. In drawing the line, I considered that it must be above all the speed points that were affected by wheel slip due to ABS. Note that I extended the red line to time = 0 seconds. Due to the method in which EDRs store data, it is possible that the crash occurred at the -0.1 data point or up to 0.1 second later, at ~0.0. The slope of the line is the braking rate, which I calculated to be -15.4 kph/s (-9.6 mph/s) or -0.44 G.

Starting from 152 kph (94 mph) at -1.4 and considering braking for 1.3 and 1.4 seconds at -0.44 G; the 3% speed error due to tire size; and 4% speedometer system error, I estimated the speed at impact for the Chrysler to have been between 80 and 89 mph.

Impact Speed of the Tractor-Trailer

The tractor-trailer's impact speed may be estimated from:

1. The Chrysler's ACM-calculated delta-V,
2. The tractor-trailer's delta-V calculated from the Chrysler's delta-V,
3. An estimate of the coefficient of restitution,
4. The Chrysler's estimated impact speed, which was addressed in the previous section of this report.

The Chrysler's Delta-V

The crash was predominantly a longitudinal event for both the Chrysler and the tractor-trailer. Because of that, I will analyze the crash in one dimension only. The maximum reported longitudinal delta-V for the Chrysler was -63.4 mph (see Figure 4 on Page 16). It is commonly accepted that EDR delta-V is accurate to +/- 10% (Bortles, Biever, Carter, & Smith, 2016) and (Ruth, King, Rich, & Sadrnia, 2024). Therefore, the longitudinal delta-V was between -57 and -70 mph.

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System Status at Event (1st Prior Event)

Complete File Recorded	Yes
Safety Belt Status, Driver	Buckled
Safety Belt Status, Outboard Front Passenger	Not Buckled
Airbag Warning Lamp, On/Off	Off
Seat Track Position Switch, Foremost, Status, Driver	No
Seat Track Position Switch, Foremost, Status, Outboard Front Passenger	Not Present
Maximum Delta-V Longitudinal (MPH [km/h])	-63.4 [-102]
Time, Maximum Delta-V, Longitudinal (msec)	272
Maximum Delta-V Lateral (MPH [km/h])	8.7 [14]
Time, Maximum Delta-V, Lateral (msec)	282
Time, Operation System Time (sec)	11269502
Time, Airbag Warning Lamp On (min)	0
Event Number	1
Total Number of Events Recorded	2
Multi-Event, Number of Events (1,2)	1
Time from Event 1 to 2 (sec)	> 5
Operation Via Energy Reserve Only (Yes, No)	No
Supply Voltage at Event, ECU (V)	14.2
Temperature, Outside (deg C)	22
Event Signal Transmission, Complete (Yes, No)	Yes
Odometer at Event (km)	146246.3
Ignition Cycle, Crash	11396
VIN, Original	2C3CCABG1EH356999
VIN Recorded at Event (last 8 characters)	EH356999

Figure 4: The Chrysler's longitudinal delta-v was -63.4 mph.

The Tractor-Trailer's Delta-V

The tractor-trailer's delta-V may be calculated given the Chrysler's delta-V and weight, as well as the tractor-trailer's weight. Canadian Vehicle Specifications reports a curb weight of 3962 pounds for the 2014 Chrysler 300 (Canadian Vehicle Specifications, n.d.). The Ohio State Highway Patrol reported on the crash report that the tractor was a 2015 Volvo VNL 760 Series. However, Volvo did not produce a 760 Series in 2015. I suspect that the 760 was a typographical error for the 670 Series, which was produced in 2015. I located a 2015 Volvo VNL 670 for sale at Commercialtrucktrader.com (Photograph 5 on Page17).

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Photograph 5: 2015 Volvo VNL 670 for sale at Commercialtrucktrader.com.

The for-sale truck appears to be the same type of Volvo VNL that was involved in the crash. The Diesel Truck Index reports that the curb weight of a 2015 Volvo VNL 670 is 16907 pounds (Truck Index, Inc., 2015). I do not have a source for the tare weight of the 2008 Stoughton refrigerated trailer (reefer). Information that I found at Trucker's Report suggests 14500 to 15500 pounds (Trucker's Report, n.d.). The Utility Keystone website reports a tare weight for a Utility reefer to be 14555 pounds. I used 14555 pounds for the tare weight of the trailer. The United States Cold Storage Bill of Lading #99317 indicates a load weight of 7158 pounds. I estimated the total weight of the truck to be ~38620 pounds. The results of my reconstruction are not sensitive to uncertainties in the weight of the tractor-trailer.

Coefficient of Restitution

The coefficient of restitution cannot be measured except during a well-controlled crash test.[3] To estimate the coefficient of restitution for this crash I relied on the research of Monson and Germane (Monson & Germane, 1999) and Atarod (Atarod, 2020). Monson and Germane researched passenger vehicle vs. passenger vehicle (VTV) and passenger vehicle vs. barrier crash tests. The restitution values for the VTV tests were 0.15 or less. Atarod

[3] See the definition of coefficient of restitution on Page 9.

researched passenger vehicle vs. semitrailer underride guards. He also found restitution values below 0.15 along with a relationship between offset and lower restitution values. The collision involving the Chrysler 300 was an offset collision as is evident in Photograph 6 below and Photograph 7 below.

Photograph 6: Front view of Chrysler 300. STARS photo DSC_0032.jpg

Photograph 7: Rear view of trailer. OSHP photo DSCN9847.

The high closing speed and offset nature of the crash means a lower restitution coefficient for this crash; however, I ranged the restitution from 0 to 0.15.

Truck Impact Speed Analysis

I performed a statistical analysis known as Monte Carlo Analysis to determine a range for the collision closing speed and a range for the truck's impact speed. Table 1 lists the uniform probability ranges that I used for the input variables. The analyses were comprised of 15000 simulations. Both analyses are reported to a reasonable degree of scientific certainty.

Input	Range
Speed at impact for the Chrysler	80.1 to 88.6 mph
Chrysler Delta-V	57.1 to 69.7 mph
Restitution Coefficient	0 to 0.15

Table 1: Monte Carlo simulation inputs.

The results of the Monte Carlo analysis were a closing speed of 62 to 69 mph and the truck's impact speed of 16 to 23 mph.

Analysis for the Truck at 50 MPH

I also used a Monte Carlo analysis to determine the closing speed for the collision and the Chrysler's delta-V if the truck had been traveling at the 50-mph speed limit. With the truck traveling 50 mph, the closing speed would have been 32 to 37 mph and the delta-V for the Chrysler would have been reduced to -31 to -36 mph.

Probability of Serious Injury Based Upon Delta-V

Delta-V is a measure of crash severity and injury probability. The higher the magnitude of delta-V, the greater the probability of serious injury (Wang, 2022). Figure 5 on Page 21 is from the Wang report. The figure depicts cumulative probability curves for the Maximum Abbreviated Injury Scales (MAIS) 2005 revision, which was updated in 2008. Table 2 on Page 20 describes the MAIS. The Wang study relied on crash data from the 2010-2015 National Automotive Sampling System Crashworthiness Data System and

included vehicles from model year 2000 and newer. The EDR from Mr. Lately's Chrysler reported that the longitudinal delta-V was between -57 to -70 mph. The Wang study did not report values for 70-mph delta-Vs. The greatest delta-V in the study was 65 mph. Figure 5 shows that the probability of an injury of MAIS3 or greater at a 57-mph delta-V is 92% and 98% at 65 mph.[4] If the truck had been traveling at the speed limit, the Chrysler's delta-V would have been reduced to -31 to -36 mph. The probability of an injury of MAIS3 or greater at that range of delta-Vs is 14% to 24%.

Baker et al. (2021) reported uninjured vehicle occupants at longitudinal delta-Vs up to ~37 mph. Therefore, there is a possibility that Mr. Lately would have been uninjured if the truck had been traveling at 50 mph. It is more likely than not that his injuries would have been less severe had the truck been traveling 50 mph.

MAIS 1	Minor Injury
MAIS 2	Moderate Injury
MAIS 3	Serious Injury
MAIS 4	Severe Injury
MAIS 5	Critical Injury
MAIS 6	Maximum Injury (Fatal)

Table 2: Maximum Abbreviated Injury Scale (2005 Revision Updated 2008)

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[4] Percent values were calculated from the MAIS3+ formula presented in the Wang report. For MAIS3+ the formula is $P(D) = \frac{e^{-6.9540+0.1637D}}{1+e^{-6.9540+0.1637D}}$

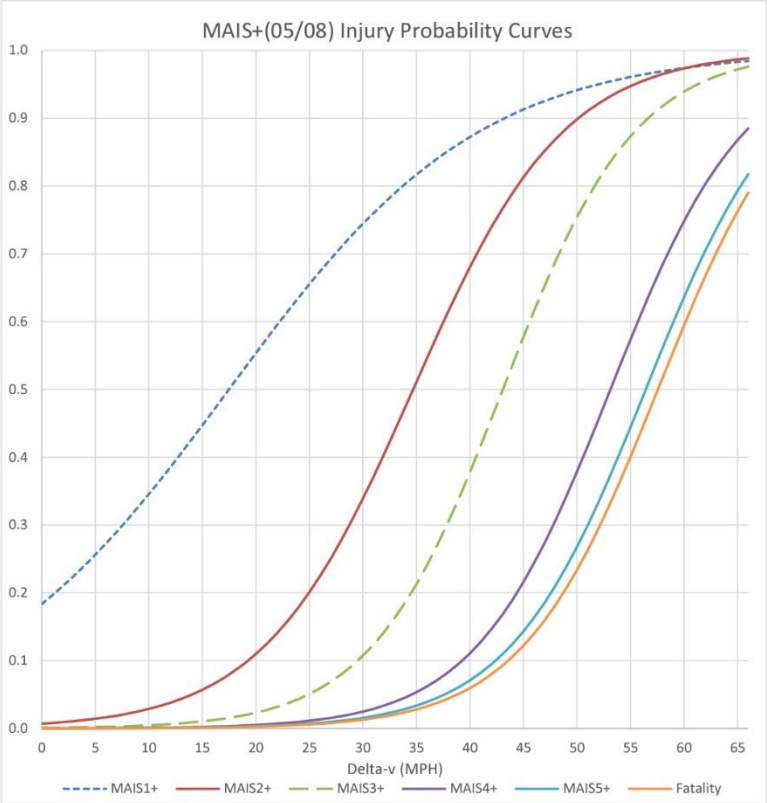

Figure 5: Figure 4-3 from Wang, 2022.

Ohio State Crash Report

The Ohio State Crash report reads, "Unit #2 [Mr. Ferrell] was parked on the right shoulder inside the barrels of the construction zone. Unit #2 entered the lanes of travel once traffic was cleared, established himself in the left lane and began accelerating to approximately 15 mph."

In a written statement given at the scene of the crash, Mr. Ferrell wrote that he was not even at 15 mph when the crash occurred and that the truck was totally straight. When asked which mirror he observed the vehicle in he wrote, "Only saw lights way off driver side."

In a written statement given at the Ohio State Highway Patrol Post, Mr. Ferrell stated that he was completely in the left lane at the time of the crash.

This crash could have been avoided if Mr. Ferrell stayed in the right lane to accelerate to the speed limit before he entered the left lane.

Conclusions and Opinions

My conclusions, within a reasonable degree of scientific certainty are:

1. Mr. Ferrell had passed The Wyandot Rest Area on the Ohio Turnpike approximately 4.5 miles west of the crash site. Because he chose to stop on the shoulder of the road to relieve himself, he was traveling between 16 and 23 mph in a 50-mph zone.
2. If Mr. Ferrell had used the rest area, he would have been able to use an acceleration ramp so that he could get up to highway speed before entering the travel lanes.
3. If the crash had still occurred when Mr. Ferrell was at the speed limit, the crash would not have been as severe and the probability for Mr. Lately to suffer from a serious injury would have been substantially reduced. The Baker research includes the possibility that Mr. Lately could have been uninjured.
4. But for Mr. Ferrell stopping in a construction zone at night, and then re-entering the highway by pulling directly into the left lane at 16 to 23 mph, the crash would not have occurred.

Andrew S. Rich, BSME, ACTAR, ASE
Signed on April 21, 2024

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Sample Calculations

The following are sample calculations using the following values for the input variables:

Weight of tractor-trailer	31400 pounds
Weight of Chrysler	3962 pounds
Chrysler impact speed	80 mph
Chrysler delta-V	-63.4 mph
Restitution	0.10

Delta-V of the tractor-trailer:

$$\Delta v_T = -\frac{w_C \Delta v_C}{w_T} = -\frac{(3962)(-63.4)}{31400} = 8.0 \text{ mph}$$

Closing Speed:

$$v_{rel,i} = \left(\frac{1}{1+\varepsilon}\right)\left(|\Delta v_C| + |\Delta v_T|\right) = \left(\frac{1}{1+0.10}\right)(63.4+8.0) = 64.9 \text{ mph}$$

Truck impact speed:

$$v_T = v_C - v_{rel,i} = 80 - 64.9 = 15.1 \text{ mph}$$

Closing speed for truck at 50 mph:

$$v_{rel,i} = v_C - v_T = 80 - 50 = 30 \text{ mph}$$

Delta-V for Chrysler when the truck is at 50 mph:

$$|\Delta v_C| = \frac{v_{rel,i}(1+\varepsilon)}{1+\frac{w_C}{w_T}} = \frac{(30)(1+0.1)}{1+\frac{3962}{38620}} = 30.0 \text{ mph}$$

Probability of MAIS3+ Injury at a Delta-V of 65 mph:

$$P(D) = \frac{e^{-6.9540+0.1637D}}{1+e^{-6.9540+0.637D}}$$

$$P(65) = \frac{e^{-6.9540+(0.1637)(65)}}{1+e^{-6.9540+(0.1637)(65)}} = 0.98$$

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PUBLICATIONS

Ruth, Richard, Hamed Sadrnia, Charles King and Andrew Rich. "Accuracy of 2016-2022 EDR's in IIHS Crash Tests." SAE Paper 2024-01-2890, April 2024.

Scurlock, Ph.D, Rich, Andrew and Kyle Poe. "Corrections to Off-Axis Delta-v Measurements from Event Data Recorders." Collision Magazine, Volume 15, Issue, 1, May 2021.

Rich, Andrew and Michelle Fish-Rich. "What is Monte Carlo Analysis." NAPARS newsletter, July 2019.

Rich, Andrew and Michelle Fish-Rich. "Using Microsoft Excel for Traffic Crash Reconstruction." Impact, Volume 24, No. 2. Autumn 2016.

Bartlett, Wade, Bill Wright and Andrew Rich. "Passenger Car Coastdown Rates." Accident Reconstruction Journal, Volume 26, No. 3. July/August 2016.

Reade, Mike W. and Andrew Rich. "The Effects of Carry Distance, Takeoff Angle, Friction Value, and Horizontal Speed Loss Upon First Ground Contact on Pedestrian/Cyclist Crash Reconstruction." World Reconstruction Exposition publication, March 2016.

Rich, Andrew and Michelle Fish-Rich. Fundamentals of Statistics for Traffic Crash Reconstruction. Jacksonville: University of North Florida, IPTM, 2014. ISBN 978-1-934807-13-2.

Rich, Andrew S. "A Geometric Analysis for Estimating Collision Force for Narrow Object Impacts." Accident Reconstruction Journal, Volume 22, No. 2. March/April 2012.

Rich, Andrew S. and Joseph N. Cofone. "Side Impacts into Poles: The Effect of Rotation on Stiffness Coefficients." Accident Reconstruction Journal, Volume 22, No. 2. March/April 2012.

Rich, Andrew, Bill Wright, and Michelle Fish-Rich. "EDR Delta-V Reliability and Restitution Values for Six Low- and Moderate-Speed Collinear Central Crash Tests." Accident Reconstruction Journal, Volume 20, No. 6. November/December 2010.

Daily, John G., Jeremy S. Daily, and Andrew S. Rich. "A Method For Vehicle-Wooden Utility Pole Impact Speed Reconstruction." Accident Reconstruction Journal, Volume 19, No. 5. September/October 2009.

Rich, Andrew S., et al. "2008 Joint Conference Lateral Pole Crash Test Results." Momentum, Volume 16, Issue 1, April 2009.

Rich, Andrew S. Concepts from Physics and Mathematics Applied to Traffic Crash Reconstruction. Jacksonville: University of North Florida, IPTM, 2007. ISBN 978-1-934807-02-6. Second Edition 2020.

Cofone, Joseph N, Andrew S. Rich, and John C. Scott. "A Comparison of Equations for Estimating Speed Based on Maximum Static Deformation for Frontal Narrow-Object Impacts." Accident Reconstruction Journal, Volume 17, No. 6. November/December 2007.

Rich, Andrew S, and Nathan Shigemura. Balancing Collision Forces in Crush/Energy Analyses. Jacksonville: University of North Florida, IPTM, 2007. ISBN 978-1-934807-03-3.

Rich, Andrew S. "An Introduction to the Monte Carlo Method." Momentum, Vol. 13, Issue 2, August 2006.

Rich, Andrew S. "EBS and Delta-V." Momentum, Vol. 13, Issue 1, February 2006.

Rich, Andrew S. "Momentum Revisited." Momentum, Vol. 11, Issue 1, February 2004

Rich, Andrew S. "A Special Case in the Conservation of Collinear Momentum." Momentum, Vol. 10, Issue 1, March 2003

Rich, Andrew S. "A Three-Point Airborne Trajectory Analysis: An Application of the Derivative." Momentum, Vol. 6, Issue 3, September 1999, and Traffic Accident Reconstruction Origin, July 1999.

Rich, Andrew S. "Solving Second-Degree and Systems of Equations: Applications to Motor Vehicle Accident Reconstruction." Traffic Accident Reconstruction Origin, April 1998, and Momentum, Vol. 5, No. 1, March 1998.

Rich, Andrew S. "Update on the Motorcyclist/Bicyclist Equation." Momentum, Vol. 4, No. 2, January 1998, and Traffic Accident Reconstruction Origin, October 1997.

Rich, Andrew S. "Estimating Vault Distance and Speed After a Motorcyclist or Bicyclist Ejection." Traffic Accident Reconstruction Origin, October 1997, and Momentum, Vol. 3, No. 2, September 1996.

INVITED LECTURES

EDR Analyst Equations

- National Association of Professional Accident Reconstruction Specialists, Symposium on EDR Research and Testing. Oklahoma City, OK—April 9, 2024.

Event Data Recorder Update

- University of North Florida, IPTM Symposium on Traffic Safety. Orlando, FL—June 27 and June 28, 2023.

A Career in Crash Reconstruction

- California State University (Sacramento) School of Engineering—April 13, 2023.

Event Data Recorders for Attorneys Webinar

- Ohio Association for Justice—December 15, 2021.

Event Data Recorders: Past Present and Future

- Alabama Prosecutorial Traffic Homicide Conference. Pelham, AL—September 30, 2021.

Using EDR Delta-V to Calculate Closing Speed & Impact Speed—Advanced Concepts

- University of North Florida, IPTM Symposium on Traffic Safety. Orlando, FL—June 22 and 23, 2021.

Event Data Recorder Update

- National Association of Professional Accident Reconstruction Specialists webinar. February 24, 2023.
- Pennsylvania Collision Analysis and Reconstruction Society Conference. Erie, PA—October 25, 2022.
- New Jersey Association of Accident Reconstructionists Joint Conference. Atlantic City, N.J.—October 8, 2019.

Sensitivity Analysis: Finite Difference and Monte Carlo Simulation

- Pennsylvania State Police Collision Reconstruction Seminar. Gettysburg, PA—October 31, 2018.

Using Simultaneous Equations in Traffic Crash Reconstruction

- Pennsylvania State Police Collision Reconstruction Seminar. Gettysburg, PA—October 31, 2017.

Post-Crash Mechanical Inspections

- Illinois Association of Technical Accident Investigators 2017 Conference. Springfield, IL—October 4, 2017.
- Ohio Traffic Accident Reconstruction Association. West Chester, OH—November 16, 2018.
- Summit Metro Crash Response Team. Hudson, OH—November 15, 2018.

ABS Braking Systems and ABS Braking Test Results

- Illinois Association of Technical Accident Investigators 2017 Conference. Springfield, IL—October 5, 2017.

Using Monte Carlo Simulation to Determine the Sensitivity of Crash Reconstructions

- New Jersey Association of Accident Reconstructionists. Sayreville, N.J.—July 11, 2017.

Using Monte Carlo Simulation and the Method of Finite Differences to Determine the Sensitivity of Crash Reconstructions (*one-day class*)

- Pennsylvania State Police. Greensburg, PA—May 10, 2017.

***Damage Analysis* (one-day class)**

- Ohio Traffic Accident Reconstruction Association. West Chester, OH—November 3, 2016.

Using Event Data Recorder Delta-V to Calculate Closing and Impact Speeds

- Illinois Association of Technical Accident Investigators 2015 Conference. East Peoria, IL—September 18, 2015.
- Pennsylvania State Police Collision Reconstruction Seminar, State College, PA—October 15, 2015.

The Effects of Rotation on Event Data Recorder Measured Delta-V and Closing Speed Analysis

- Pennsylvania State Police Collision Reconstruction Seminar. State College, PA—September 25, 2014.

Fundamentals of Statistics for Traffic Crash Reconstruction (presented with Michelle Fish-Rich)

- University of North Florida, IPTM Special Problems. St. Pete Beach, FL—April 30 and May 1, 2014.

Fundamentals of Statistics for Traffic Crash Reconstruction

- World Reconstruction Exposition (WREX 2016). Orlando, FL—May 4, 2016

Investigating Pedestrian/Bicycle Crashes Requiring Special Considerations (presented with Mike Reade)

- University of North Florida, IPTM Special Problems. St. Pete Beach, FL—May 20, 2013.

Advanced Momentum Concepts

- University of North Florida, IPTM Special Problems—May 22 and 23, 2013.
- Illinois Association of Technical Accident Investigators 2013 Conference. Peoria, IL—September 20, 2013.
- Pennsylvania State Police Collision Reconstruction Seminar. State College, PA—September 26, 2013.
- New Jersey Association of Accident Reconstructionists Joint Conference. Atlantic City, N.J.—October 10, 2013.

- Ohio Traffic Accident Reconstruction Association Annual Training. West Chester, OH—November 8, 2013.

Rotational Mechanics

- NYSTARS Joint Conference. Kingston, N.Y.—October 19, 2012.

Tumbas-Smith Damage Measurement Protocol

- Pennsylvania State Police Collision Reconstruction Seminar. State College, PA—September 26, 2012

Basic Damage Analysis

- University of North Florida, IPTM Special Problems—May 2 and 3, 2012.

Expert Witnesses (Presented with Bergen County First Assistant Prosecutor John L. Higgins III)

- Justice Morris Pashman American Inn of Court. Hackensack, N.J.—February 21, 2012.

Pedestrian Crash Test Data Analysis

- NATARI Combined Conference. Harrisburg, PA—October 7, 2011.

EBS, KEES, Delta-V and the First Law of Thermodynamics

- Illinois Association of Technical Accident Investigators 2009 Conference. Bloomington, IL—September 17, 2010.
- Maryland Association of Traffic Accident Investigators. Ocean City, MD.—October 8, 2010.
- Pennsylvania State Police Collision Reconstruction Seminar. State College, PA.—September 28, 2016.

Instrumentation and Testing for Crash Reconstruction (with Bill Wright, BSME, ACTAR)

- University of North Florida, IPTM Special Problems—April 28 and 29, 2010.

Physics and Mathematics Applied to Collision Reconstruction

- Pascack Hills High School (N.J.), honors physics curriculum—April 20, 2010, March 2011.
- Pascack Valley High School (N.J.), honors physics curriculum—April 20, 2010, March 2011.
- Northern Highlands High School (N.J.), physics AP class—June 15, 2010.

Using Microsoft Excel for Traffic Crash Reconstruction

- Ohio Traffic Accident Reconstruction Association. London, OH—January 22, 2010.
- Illinois Association of Technical Accident Investigators 2010 Conference. Bloomington, Il. —September 14, 2010.
- Pennsylvania State Police Academy (3-day class). Harrisburg, PA. February 2011.
- University of North Florida, Jacksonville, FL—May 4 and 5, 2011.
- Tennessee Highway Patrol Crash Reconstruction Seminar. Franklin, TN—May 27, 2015.
- Tennessee Highway Patrol Crash Reconstruction Seminar. Nashville, TN—June 1, 2016.

Case Analysis

- Illinois Association of Technical Accident Investigators 2009 Conference. Bloomington, Il. —September 17-18, 2009.
- University of North Florida, IPTM Special Problems—April 26 and 27, 2010.
- Pennsylvania State Police Crash Reconstruction Seminar—September 2010.

2008 Joint Conference Lateral Pole Crash Test Results

- New Jersey Association of Accident Reconstructionists, April 28, 2009.

Lateral Pole Impact Testing Analysis (Presented with the Collision Safety Institute)

- New Jersey Association of Accident Reconstructionists Joint Conference. Atlantic City, N.J.—October 17, 2008.

Airborne Trajectories and Analysis

- Ohio Traffic Accident Reconstruction Association. London, OH—July 24, 2009.
- New Jersey Association of Accident Reconstructionists Joint Conference. Atlantic City, N.J.—October 16, 2008.
- University of North Florida, IPTM Special Problems—April 15 and 16, 2009.
- Illinois Association of Technical Accident Investigators 2009 Conference. Bloomington, Il. —September 17-18, 2009.
- Pennsylvania State Police Collision Reconstruction Seminar—October 26, 2011.

Applied Statistics for the Collision Reconstructionist

- West Chester, OH Police Department—September 5, 2008.

Narrow-Object Collision Reconstruction

- West Chester, Ohio Police Department—September 5, 2008.

A Comparison of Equations for Estimating Speed Based on Maximum Static Deformation for Frontal Narrow-Object impacts

- University of North Florida, IPTM Special Problems—April 24, 2008.

Balancing Collision Forces in Crush/Energy Analyses—Presented with Nathan Shigemura

- University of North Florida, IPTM Special Problems—April 30 and May 1, 2007.
- Illinois Association of Technical Accident Investigators—September 20 & 21, 2007.

Critical Speed Yaw Analysis

- New Jersey Association of Accident Reconstructionists "Back to the Basics Conference"—September 7, 2006.

A New Look at Momentum for the Police Reconstructionist

- Pennsylvania State Police Collision Reconstruction Seminar—September 28, 2004.
- New Jersey Association of Accident Reconstructionists—March 1, 2004.

Pedestrian Collision Reconstruction and Investigation Techniques

- AAA Traffic Safety and Crash Investigation Conference—October 13, 2004.
- New York Statewide Traffic Accident Reconstruction Society—February 24, 2004.
- The College of New Jersey: guest speaker for a class titled, "Laboratory and Field Analysis in Forensic Investigations"—March 17, 2003; April 5, 2004; April 7, 2005.
- New Jersey State Police Academy—August 14 and October 2, 2002.
- New Jersey Association of Accident Reconstructionists—June 10, 2002.
- Morris County Prosecutor's Office—May 20, 2002.
- New Jersey Prosecutor's Crash Investigator's Association—December 4, 2001.
- Bergen County Prosecutor's Office—November 30, 2001.

A Three-Point Airborne Trajectory Analysis: An Application of the Derivative

- Pennsylvania State Police Collision Reconstruction Seminar—September 28, 2004.
- New York Statewide Traffic Accident Reconstruction Society—February 24, 2004.
- University of North Florida, IPTM Special Problems—April 30 and May 1, 2003.
- New Jersey Association of Accident Reconstructionists – September 27, 1999.

Estimating Vault Distance and Speed After a Motorcyclist or Bicyclist Ejection

- New Jersey Association of Accident Reconstructionists—September 30, 1996
- Bergen County Prosecutor's Office—June 21, 1996

TECHNICAL CONSULTATIONS

Provided technical consultations and assistance for the following publications and computer software applications:

- Bonnett, George. Rec-Tec computer program. Provided technical assistance with pole impact analysis.
- AITools. WinCRASH computer program User's Manual (CRASH3 software). Provided corrections to the statistical analyses.
- Cofone, Joseph N. A Guide to Determining Occupant Seating Positions and Injury Patterns. Jacksonville: IPTM, 1997.
- Cofone, Joseph N. Rollover Crashes of Motor Vehicles and Heavy Trucks. Jacksonville: IPTM, 2002.
- Mitchell, J.F. International Guidebook for Traffic Accident Reconstruction. Ontario: Self-published, 1997.
- Russell, C. Greg. Pedestrian Formulas for Excel. Tucson: Lawyers and Judges.
- Young, Kelly. AR Pro. Hollowell, ME: Maine Computer Group.
- Reade, Michael. PedBike2000 Plus & Impact. New Brunswick: Forensic Reconstruction Specialists, Inc.
- 4N6XPRT. StifCalcs computer program. Provided beta testing and technical consulting for the balancing forces section of the software.
- Beta tester for FARO Zone3D software.

- Past beta tester for M-Smac simulation software.